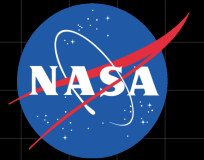


# **Augmented Reality Devices for Robotic Operators**

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Satellite Servicing Capabilities Office

Contributors:  
Julianna Long, Sreya Vangara, Luke Miller

# Augmented Reality



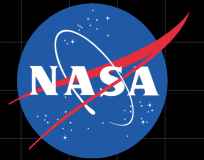
**Reality**  
**[PHYSICAL]**



**Augmented**  
**[DIGITAL]**



# Augmented Reality



## Google Glass

Glanceable peripheral display

Puts information nearby

Display independent of physical world

## Microsoft Hololens

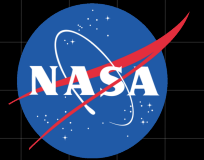
3-D holographic display

Information central to wearer vision

Holograms overlay & interact with  
physical world

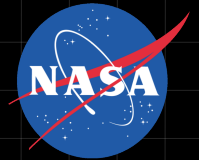


# Robot Operations

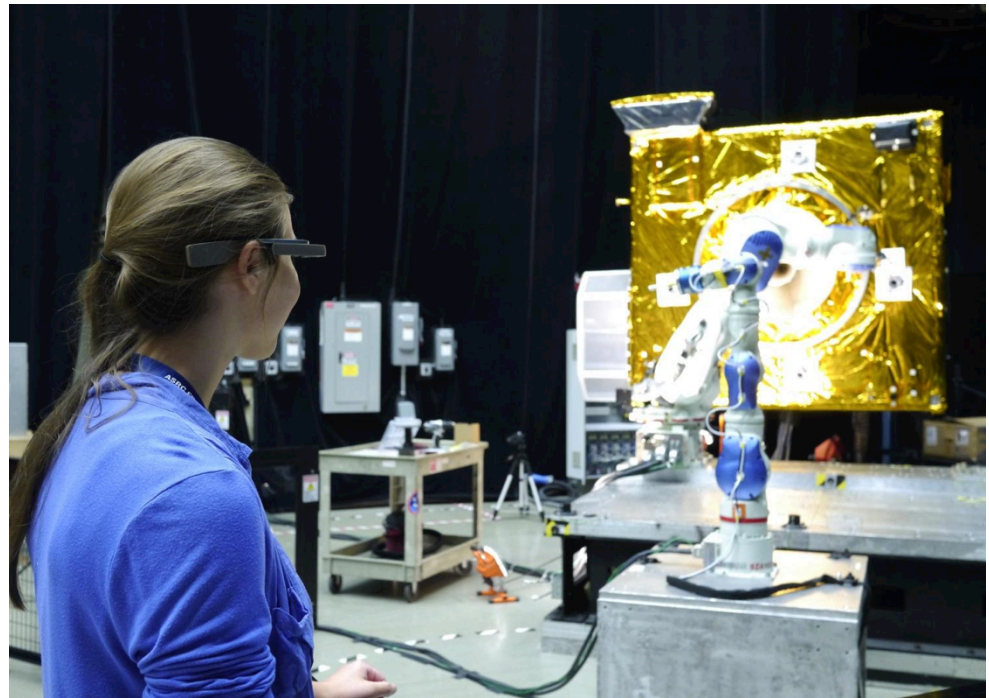




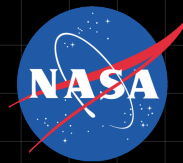
# Improved Awareness with Google Glass



- Glass display provides live telemetry data
- Voice recognition allows hands free operation
- Increase operator ability to view situational awareness cameras through decreased reliance on numeric display screens



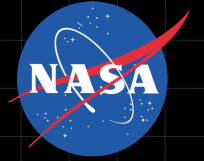
# Improved Awareness with Google Glass



2:01

"ok, glass"

# Improved Awareness with Google Glass

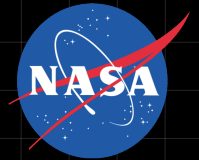


# ARDUORS

Tap twice to start measuring.  
See Information for help.

3:10 PM

# Improved Awareness with Google Glass



ARDUORS

Tap twice to start measuring.  
See Information for help.

▢ Force Data

ARDUORS

Tap twice to start measuring.  
See Information for help.

▢ Telemetry Data

ARDUORS

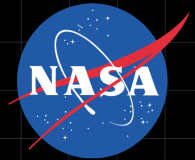
Tap twice to start measuring.  
See Information for help.

☰ Information

3:12 PM



# Improved Awareness with Google Glass



Joint 1: 0.00      Joint 5: 0.00  
Joint 2: -72.11    Joint 6: -63.15  
Joint 3: 0.00      Joint 7: 0.00  
Joint 4: 135.26

3:13 PM

Joint 1

0.0

" ok glass "

1:45 PM

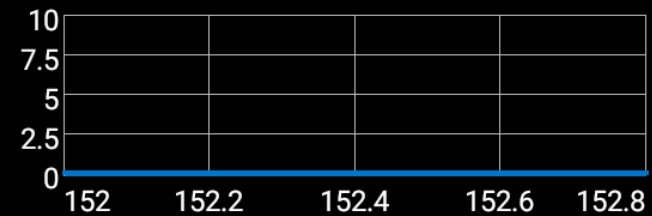
X: 0.00      Roll: 135.26

Y: -72.11      Pitch: 0.00

Z: 0.00      Yaw: -63.15

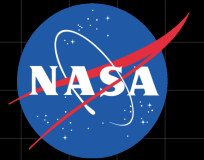
3:15 PM

Pitch



3:18 PM

# Improved Awareness with Google Glass



Joint 1: 0.00

Joint 2: 0.00

Joint 3: 0.00

Joint 4: 0.00

Joint 5: 0.00

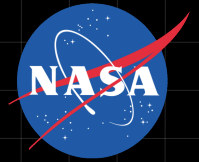
Joint 6: 0.00

Joint 7: 0.00

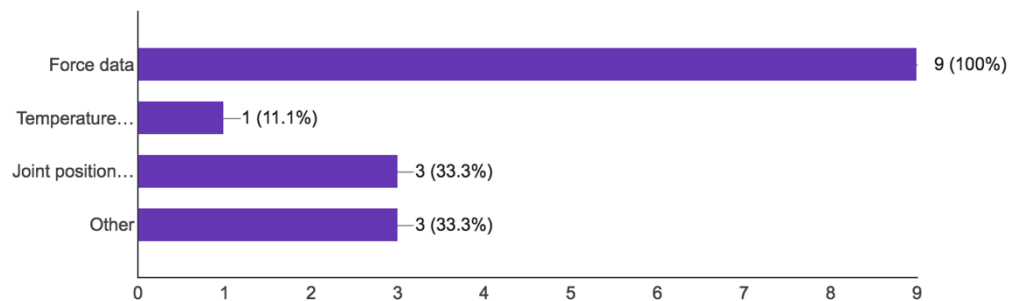
Alert!  
"ok glass "

1:43 PM

# Improved Awareness with Google Glass

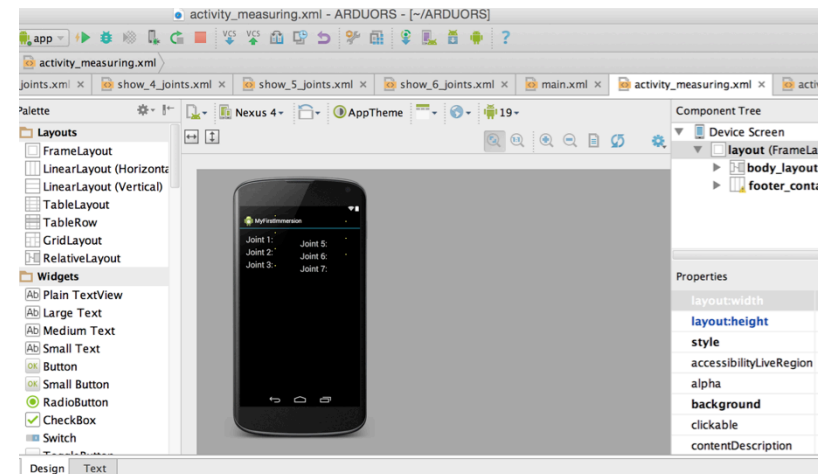


Which data would you like to be able to see via Glass? (9 responses)

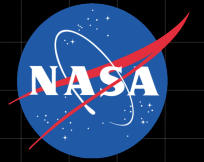


Survey of robot operators

Written using Android Studio in Java & XML

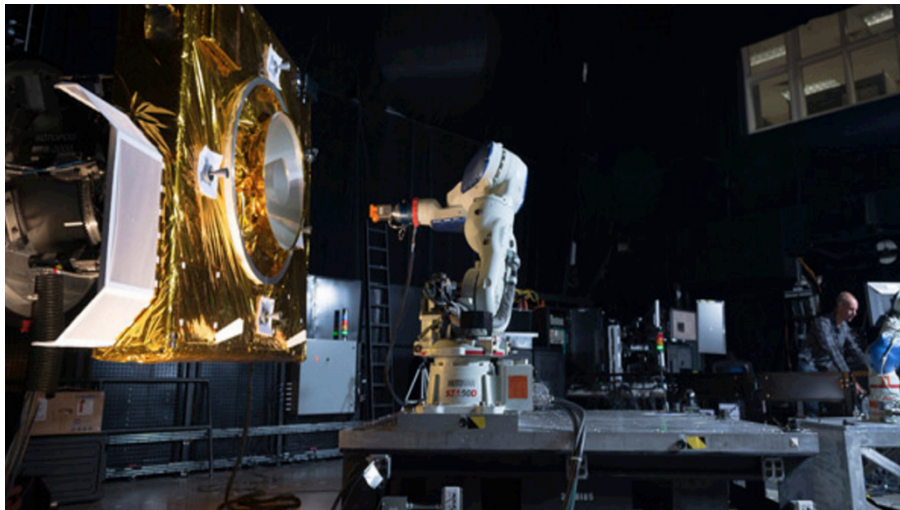


# Improved Awareness with Google Glass



## Continued Development

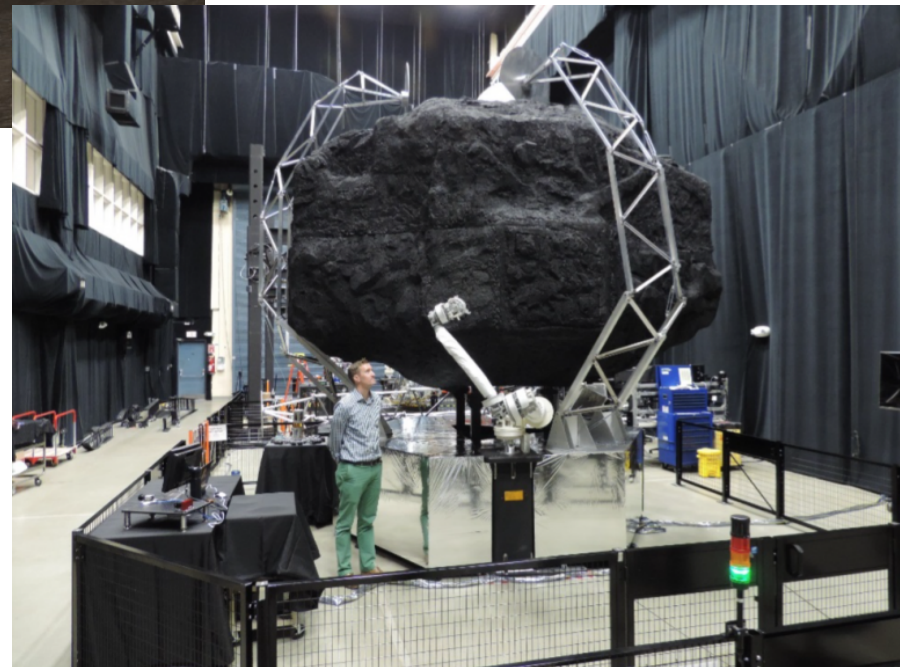
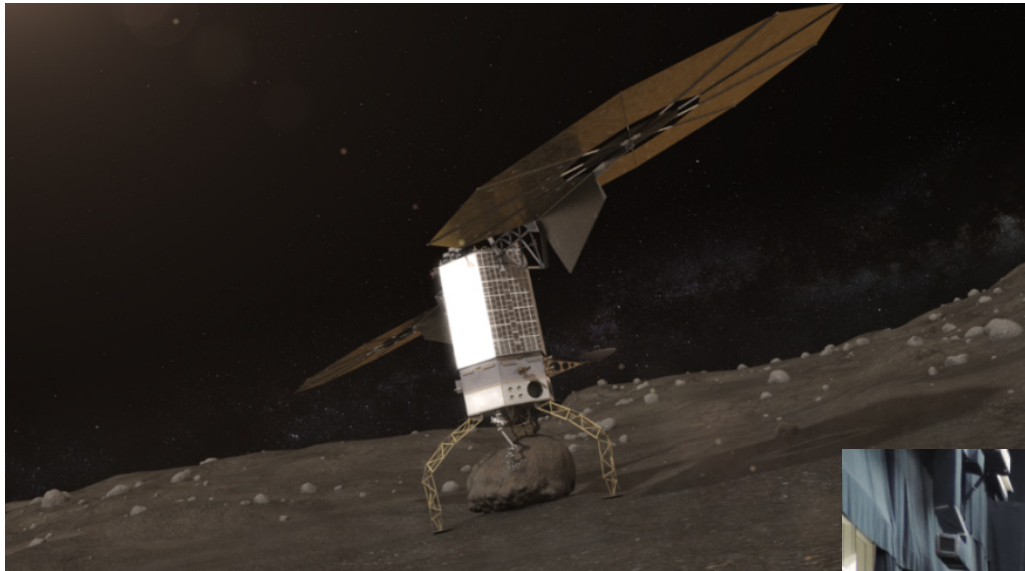
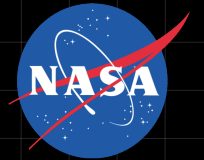
Graphical indicators for telemetry display



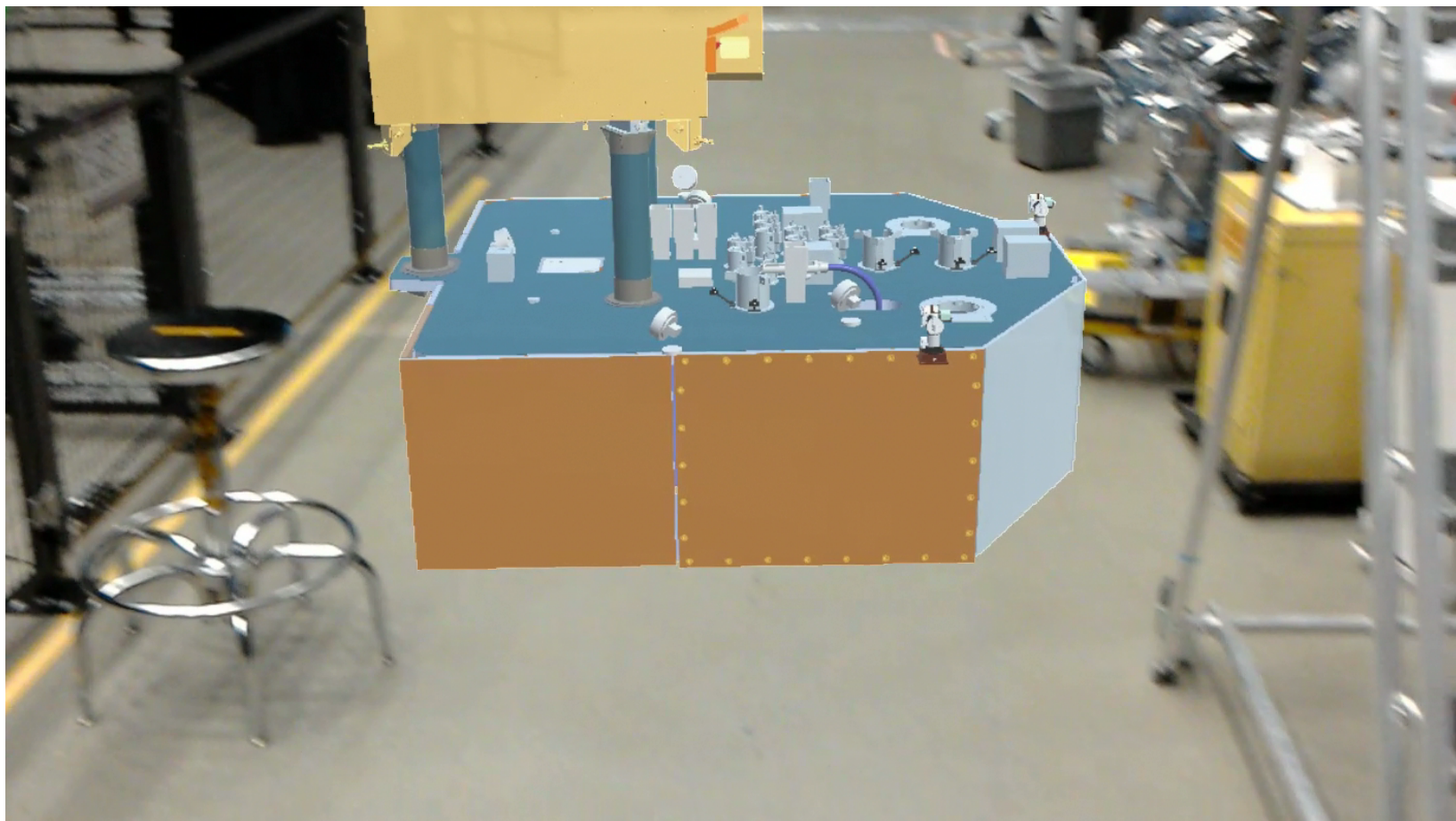
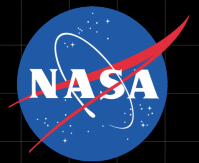
Integration with ground robot control software



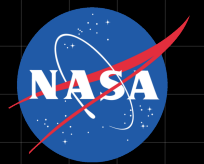
# Holographic Overlay with Microsoft Hololens



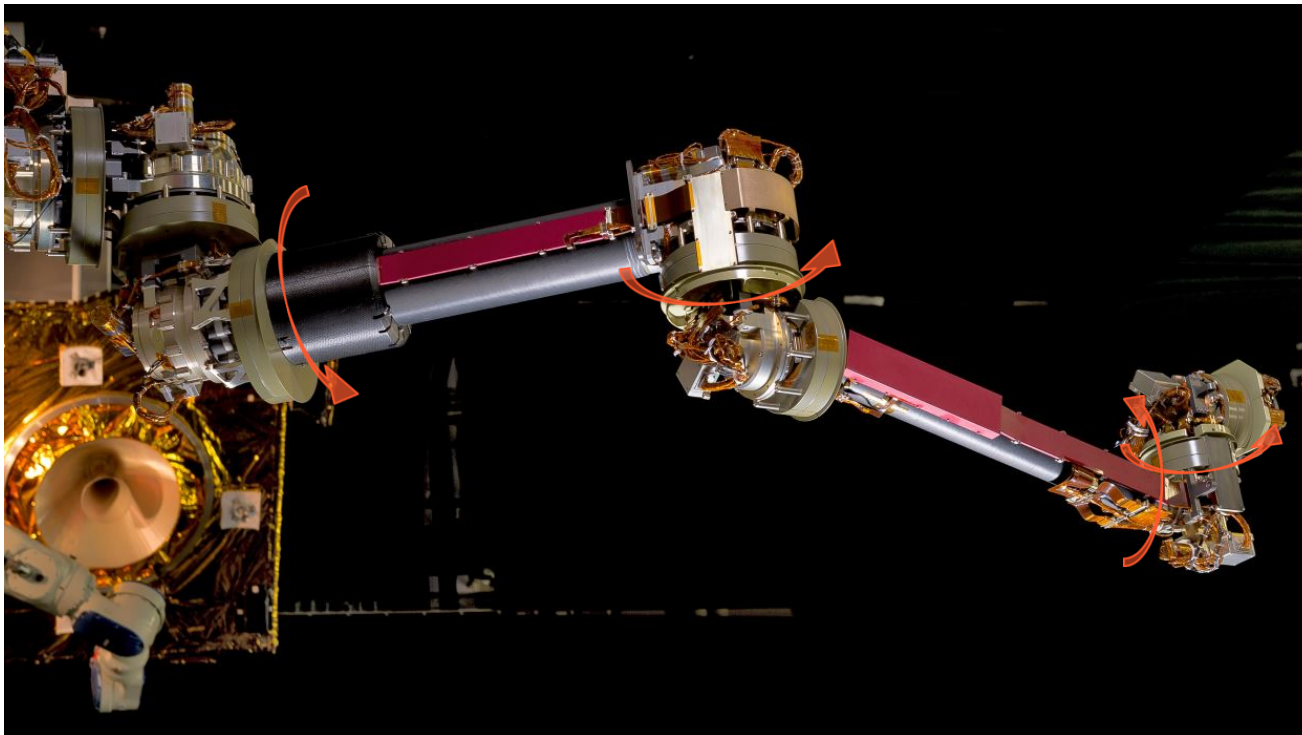
# Holographic Overlay with Microsoft Hololens



# Holographic Overlay with Microsoft Hololens



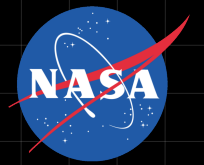
## Continued Development



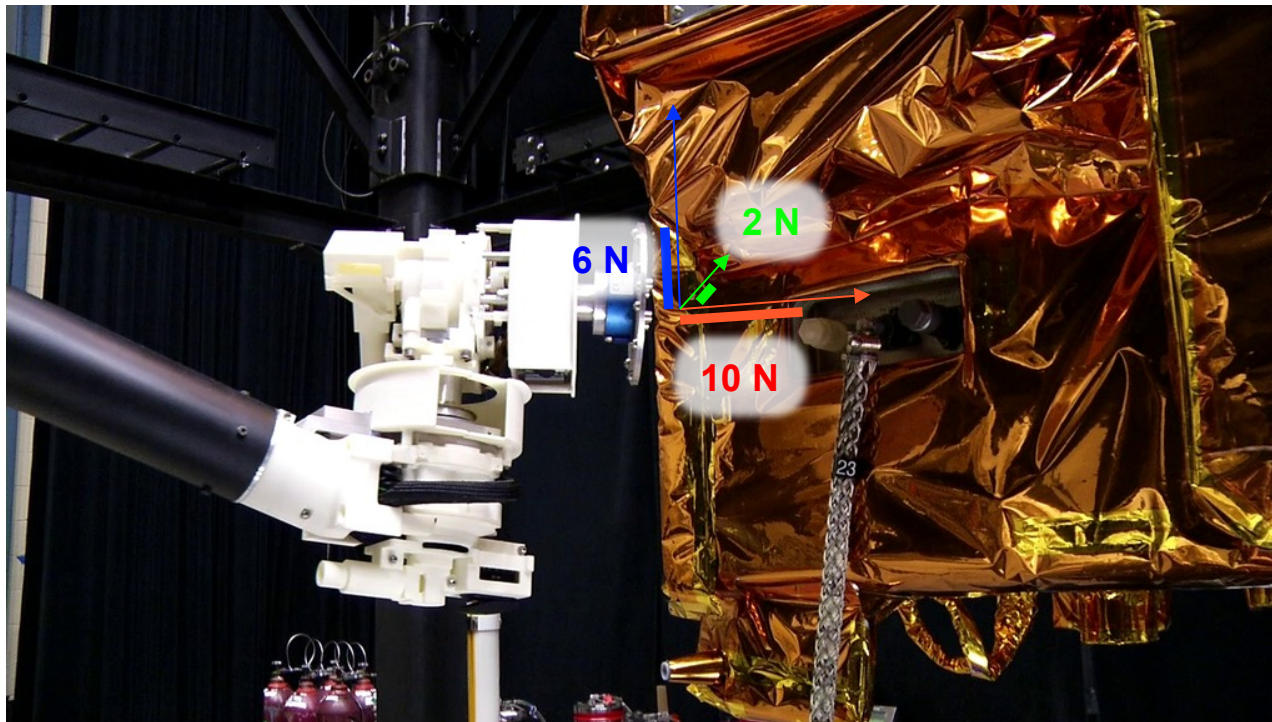
Engineering data overlay on robot



# Holographic Overlay with Microsoft Hololens

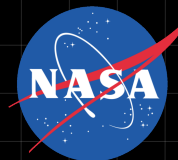


## Continued Development



Direct overlay of telemetry for ground testing





## **Satellite Servicing Capabilities Office**

**NASA's Goddard Space Flight Center**

**Greenbelt, MD**



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